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GB 1336481
GB 1203745
GB 1159081
GB 1099425
GB 1050078
GB 991945
GB 935747
GB 927545
GB 886916
GB 858977
GB 672467
GB 407998
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(71) Applicants
Hokuto Onkyo Co. Ltd,
9-17 Yotsugi 5-chome,
Katsushika-ku,
Tokyo,
Japan.
(72) Inventors
Tetsuro Yamamoto
(74) Agents
Marks & Clerk

# (54) Magnetic circuit of a loud speaker

(57) A ferrite magnet is employed as the permanent magnet 2 of an internal magnet type loud speaker magnetic circuit in which the magnet 2, which has a square plan, is located within a yoke 1. The pole of the magnetic circuit is constituted by a cylindrical centre pole portion 3*a* between which and the yoke a gap is formed, and a tapered portion 3*b* which narrows towards the centre pole portion 3*a*. This arrangement results in a low flux leakage from the magnetic circuit.

FIG. 1

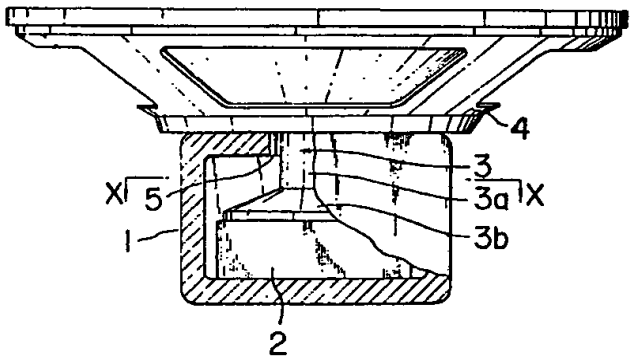


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FIG. 1

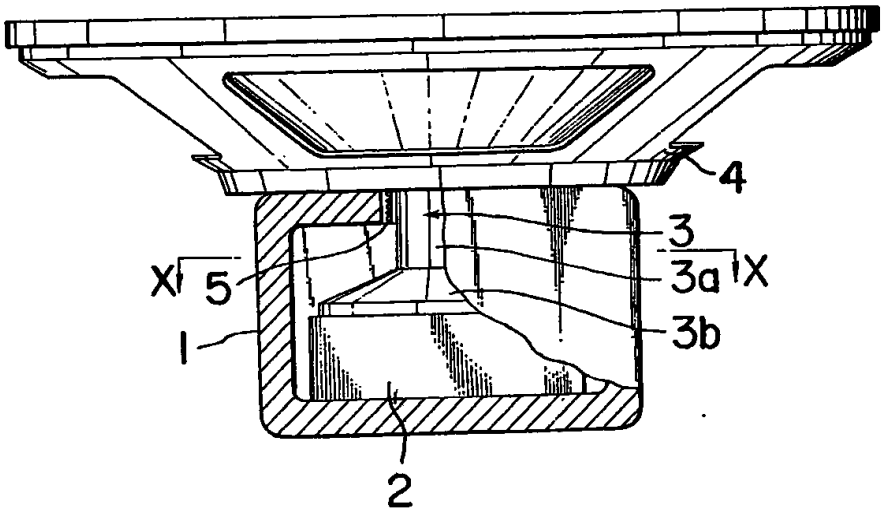


FIG. 2

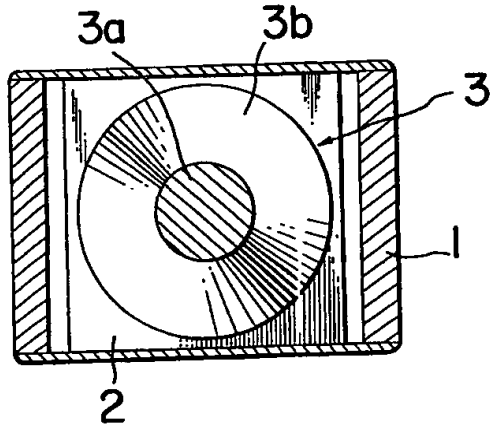

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FIG. 3

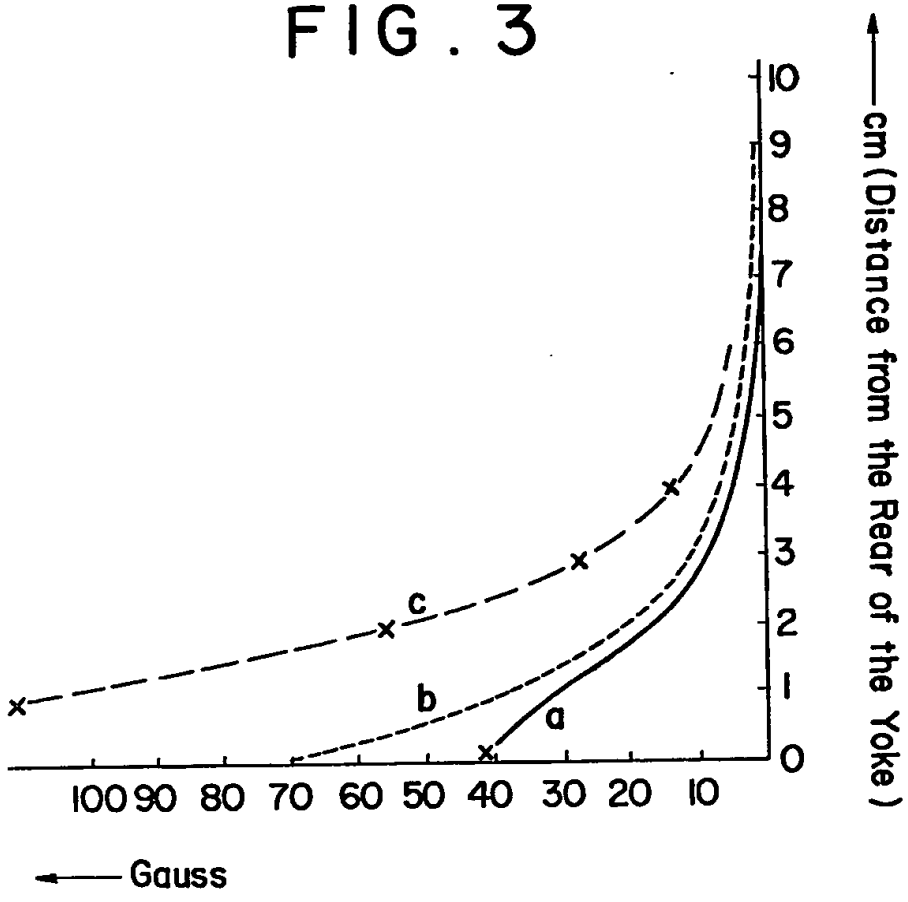

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FIG. 4

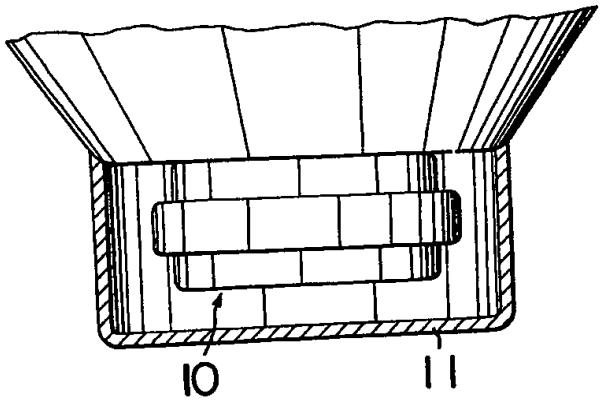
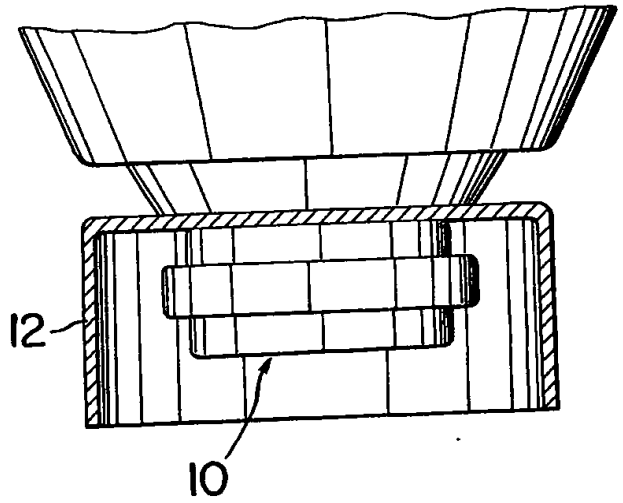



FIG. 5



SPECIFICATION

**Magnetic circuit of a speaker**

The present invention relates to an internal magnet type loud speaker magnetic circuit.

Most external magnet type magnetic circuits employ ferrite permanent magnets, but they have the disadvantage that the leakage flux rate is high. In order to alleviate this disadvantage the magnetic field 10 is sometimes covered with a metallic casing 11 provided with a bottom as in Figure 4 or with an open-bottomed shielding plate 12 as in Figure 5. These leakage-lowering measures are not entirely satisfactory when used for colour television sets since they can reduce the picture quality.

Further, methods such as arranging the magnetic field of an external magnet type circuit within the speaker frame (not shown in the drawings) have been used but cannot usually be employed for small radii speakers since they tend to be too large and problems can also arise when high magnetic circuitry energy is required, even with large radii speakers.

An object of the present invention is to provide an internal magnet type loud speaker magnetic circuit having a low leakage flux rate.

According to the present invention, an internal magnet type loud speaker magnetic circuit having a permanent magnet located within a yoke is characterised in employing a ferrite magnet as the permanent magnet.

The invention will now be described, by way of example, with reference to the accompanying drawings in which:-

*Figure 1* is a partially cutaway elevational view of a loud speaker employing the magnetic circuit of the present invention;

*Figure 2* is a transverse sectional plan along the line X-X of Figure 1;

*Figure 3* is a diagram showing the rear leakage in magnetic circuits; and

*Figures 4 and 5* are elevational views of two conventional speakers, in which principal elements are omitted.

Referring to the drawings, a yoke 1 constitutes an internal magnet type magnetic circuit of a loud speaker and contains a ferrite permanent magnet 2. Reference numeral 3 indicates a pole, and the speaker includes a frame 4 and a voice coil 5. The pole 3 is constituted by a cylindrical centre pole portion 3*a* between which and the yoke is formed a gap in order to diminish the permeance and also to provide a uniform magnetic field therein, and also by a tapered portion 3*b* which narrows towards the centre pole portion 3*a*.

When the permeance in the gap is indicated as Pg, the permeance related to the pole and the yoke, etc. as Pf and that related to the magnet as Pfo, the total permenace in a magnetic circuit Pt can be indicated as

$$Pt = Pg + Pf + Pfo,$$

and leakage co-efficient $\sigma = \frac{Pt}{pg}$ can be obtained.

Accordingly, leakage flux of the magnetic circuit of the present invention in which the permeance Pf of the outer periphery of the pole 3 and the inner periphery of the yoke 1 is decreased, can be kept quite low. The lowered leakage co-efficient, in turn, heightens the efficiency of the magnetic circuit itself and thus, it is possible to present a magnetic circuit itself and thus, it is possible to present a magnetic circuit with high enough circuit efficiency comparable with that obtained with conventional external magnet type magnetic circuits.

With respect to ferrite type magnets, permeance in the magnetic circuit is more affected by the size of the sectional area of the magnet is contact with the magnetic circuit than the thickness of the magnet itself. The greater the sectional area, the easier it is to keep permeance low, and, therefore, when the size of the magnetic circuits is the same, using a permanent magnet with a square plan as in Figure 2 rather than one with a circular plan is preferable as the permenance can be kept lower, and the magnetic circuit of the yoke and the pole etc. can be miniaturized, decreasing manufacturing costs.

Further, when an urn-shaped yoke (with no side openings) is employed, it is necessary to design the distance between the magnet and the inner surface of the yoke wider than that of the square yoke as the magnet itself is surrounded by the yoke and leakage flux from the magnet surface is increased.

By employing the ferrite permanent magnet which has never been used in an internal magnet type magnetic circuit, the present invention, thus, decreases leakage flux in the magnetic circuit as shown as "a" of the diagram in Figure 2 when compared with that of magnetic circuit "b" which is currently used for colour television sets and that of external magnet type magnetic circuit "c" with a centre pole 14. (magnetic flux)

By constituting the pole 3 from the cylindrical centre pole portion 3*a* and the tapered portion 3*b* which narrows towards the centre pole, and forming a gap between the pole portion 3*a*, and the yoke, permeance between the pole and the yoke is decreased, lowering magnetic flux density. Moreover, loss of magnetomotive force is retained at a minimum, while a uniform magnetic field is achieved in the gap.

Further, it is possible to provide speakers at a low cost and to stabilize such provision by employing ferrite permanent magnets which do not require cobalt, the acquisition of which is unstable and often results in sudden price rises. The present invention, thus, presents many practical merits.

CLAIMS

1. An internal magnet type loud speaker magnetic circuit having a permanent magnet located within a yoke and being characterised in employing a ferrite magnet as the permanent magnet.

2. A magnetic circuit according to Claim 1 in which a pole is constituted by a cylindrical centre pole portion between which and said yoke is formed a gap, and a tapered portion which narrows towards said centre pole portion.

3. A magnetic circuit according to Claim 1 or Claim 2 in which the said permanent magnet has a square plan.

4. An internal magnet type magnetic circuit substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

5. A loud speaker incorporating an internal magnet type magnetic circuit according to any one of Claims 1 to 4.

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